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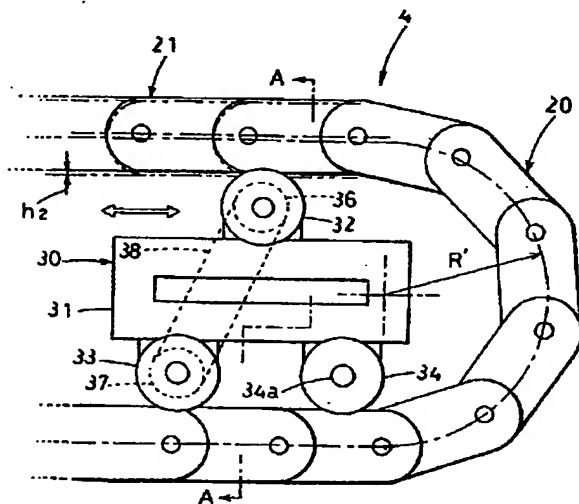
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(54) 【発明の名称】 可撓性長尺物の保護装置

(57) 【要約】

【課題】 チェーンが移動端と固定端との間の屈曲部で縦方向に曲げ返されている可撓性長尺物の保護装置において、屈曲部上端の上下動に起因する振動を抑えることによってチェーンの構成部品にかかる荷重を軽減し、チェーンの軽量化及び低コスト化を図ること。

【解決手段】 チェーン4の屈曲部20と移動端との間でチェーン4下面を所定高さに支持するとともに前記チェーン4下面に転がり接触する上部車輪32と、前記チェーン4下面と対向するチェーン4上面に転がり接触する下部車輪33、34と、上部車輪32の回転を下部車輪33に伝達する伝動チェーン38とを備えてなる移動支持体30を設けた。



## 【特許請求の範囲】

【請求項1】 チェーンを用いて可撓性長尺物の屈曲半径を一定以上に規制する保護装置であって、前記チェーンが移動端と固定端との間で縦方向に曲げ返されているものにおいて、

縦方向に曲げ返されるチェーンの屈曲部と移動端との間でチェーン下面を所定高さに支持するとともに、移動端の移動に伴い前記チェーン下面とこれに対向する固定面とに転がり接触しながら移動端の移動方向に移動する移動支持体を備えたことを特徴とする可撓性長尺物の保護装置。

【請求項2】 移動支持体は、屈曲部と移動端との間のチェーン下面に転がり接触する上部車輪と、固定面に転がり接触する下部車輪と、上部車輪の回転を下部車輪に伝達する伝動機構とを備えてなる請求項1に記載の可撓性長尺物の保護装置。

【請求項3】 チェーンの屈曲部と移動端との間に複数の移動支持体が配備されるとともに、移動端寄りの移動支持体ほど移動時の下部車輪の周速が速くなるように伝動機構の伝達比率が設定されている請求項2に記載の可撓性長尺物の保護装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、チェーンを用いてケーブルやホース等の可撓性長尺物の屈曲半径を一定以上に規制する可撓性長尺物の保護装置に関するものである。

## 【0002】

【従来の技術】ケーブルやホースは一定半径以下の曲げを与えると損傷したり所期の機能が発揮できなくなったりすることがある。そこで、ケーブル、ホース等の可撓性長尺物を機械装置等の固定部と可動部との間に設置する場合には、可撓性長尺物の許容屈曲半径以下までは屈曲しないチェーンを用いた保護装置によって可撓性長尺物を保護することが従来一般的である（実公昭55-53810号公報、実公昭61-23959号公報等参照）。

【0003】この種の保護装置は、例えば図10～図12のようなものである。すなわち、図10において符号100は可撓性長尺物の保護装置を全体的に示しており、符号2は床面を、3は床面2の上を矢印方向に往復移動する機械可動部を、4は一端（移動端5）が機械可動部3に固定され他端（固定端6）が床面2に固定された保護装置100のチェーンを、それぞれ示している。

【0004】図11に示すように、チェーン4を構成する多数のリンク7には、枢支ピン8を挿通するための孔9、10と、角度規制ピン11を挿通するための各一对の孔12及び長孔13とが形成されている。一对の長孔13は孔10を中心とする角度 $\theta$ の円弧状になっている。また、リンク7の一端側には、別のリンク7の他端

部を挿入するための隙間14が形成されている。そして、一つのリンク7の隙間14に別のリンク7の他端部を挿入し、孔9と孔10、孔12と長孔13が重なる状態で枢支ピン8及び角度規制ピン11をそれぞれ挿通し、各ピンの両端に止め輪15を嵌めることで、各リンク7が相互に連結されている。

【0005】したがって、図12に示すように、隣接するリンク7は伸長状態から一方にのみ角度 $\theta$ だけ回転できるので、チェーン4は枢支ピン8のピッチ（チェーンピッチ）と角度 $\theta$ とから決定される半径で一方にのみ屈曲できるが、逆方向には直線状態を保つ。このようなチェーン4が、図11に示すように2列並行して配置されるとともに、対向するリンク7間に介装された保持部材16によって相互に連結されている。保持部材16にはケーブル、ホース等の可撓性長尺物を挿通して保持するための複数の孔17が形成されている。

【0006】また、図10に示すように、保護装置100には固定支持ローラ18、19が設けられている。固定支持ローラ18は移動端5の移動ストロークSの中央（すなわち固定端6の上方）に配され、他方、固定支持ローラ19は固定支持ローラ18と移動ストロークSの端部との中間に配されている。これらの固定支持ローラ18、19はそれぞれ床面2に固設されたスタンド（不図示）上に回転自在に枢支されている。

【0007】また、保持部材16によって連結された2列のチェーン4は移動端5と固定端6との間で縦方向に曲げ返されるとともに、この曲げ返される屈曲部20と移動端5との間の下面が固定支持ローラ18、19に支持されるようになっていく。なお、図10の符号Kは、チェーン4の屈曲部20が固定支持ローラ18に乗り上げるのを防止するために設定された「余裕長さ」を示している。

## 【0008】

【発明が解決しようとする課題】しかし、前記従来の保護装置100には以下のような問題があった。すなわち、図13に示すように、屈曲部20でのチェーン4の屈曲半径Rは常に一定であるが、機械可動部3及び移動端5の移動に伴いチェーン4のリンク7が順次転回して屈曲部20が移動する際、チェーン4は多角形が転動するような運動をするために、屈曲部20上端（の枢支ピン8）の位置が、図13（a）のように低くなったり、図13（b）のように高くなったりして、 $h_1$ で示す範囲の上下動が生じた。

【0009】この上下動のために、屈曲部20上端とこれに隣接する支点（移動端5の位置によって、固定支持ローラ18の場合と移動端5の場合とがある）との間に支持されるチェーン4の直線部21（図10参照）が強制的に振動させられた。特に屈曲部20上端から隣接する支点までの距離（支持スパン）に応じて変化する直線部21の固有振動数が前記上下動の振動数と一致した時

には、直線部21に上下方向の激しい共振が生じることになった。

【0010】そして、以上のようなチェーン4の振動によって、リンク7の長孔13の両端部や角度規制ピン11にかかる荷重が大きくなり、特に屈曲部20のリンク7には直線部21の重量も加わるため、直線部21の約2倍の荷重がかかることになり、このような荷重に耐えられるようにする必要から、従来はチェーン4のリンク7や角度規制ピン11といった構成部品の強度を高くせざるを得ず、そのためにチェーン4の軽量化及び低コスト化が困難になっていた。

【0011】また、図10で移動ストロークSの中央よりも左側でのチェーン4の支持スパンは固定支持ローラを増設すれば任意に短縮できるが、移動ストロークSの中央よりも屈曲部20側（図10の右側）には固定支持ローラを設けることができないため、屈曲部20上端とこれに隣接する支点との間の支持スパン（移動端5が固定支持ローラ18と重なった時に $(S/4)+K$ と最も長くなる）を短縮することはできなかった。したがって、移動ストロークSが長くなるほど最長支持スパンも長くなるのでチェーン4の強度を高くせざるを得ず、反対にチェーン4の強度が一定であれば許容される最長支持スパンの関係から移動ストロークSを一定以上に延長することができなかった。

【0012】さらに、機械可動部3との衝突を避けるため、図14に示すように、固定支持ローラ18、19を機械可動部3の移動領域3Aの外に設けなければならず、このため保護装置100の全体を移動領域3A外に設置せざるを得ないことになって、専用の設置スペースを要するという問題もあった。

【0013】本発明は以上のような問題に鑑みてなされたものであって、屈曲部上端の上下動に起因する振動を抑えることによってチェーンの構成部品にかかる荷重を軽減でき、チェーンの軽量化及び低コスト化を図れる可撓性長尺物の保護装置の提供を目的とするものである。

【0014】また、前記目的に加えて、チェーンの最長支持スパンを従来よりも短縮することが可能で、また、最長支持スパンが同じであれば移動端の移動ストロークを従来よりも延長することが可能で、しかも、機械可動部の移動領域内に設置できて省スペース化を図ることも可能な可撓性長尺物の保護装置の提供を目的とするものである。

【0015】

【課題を解決するための手段】前記目的を達成するため、本発明は、チェーンを用いて可撓性長尺物の屈曲半径を一定以上に規制する保護装置であって、前記チェーンが移動端と固定端との間で縦方向に曲げ返されているものにおいて、縦方向に曲げ返されるチェーンの屈曲部と移動端との間でチェーン下面を所定高さに支持するとともに、移動端の移動に伴い前記チェーン下面とこれに

対向する固定面とに転がり接触しながら移動端の移動方向に移動する移動支持体を備えた構成としたものである。

【0016】また、前記構成において、移動支持体は、屈曲部と移動端との間のチェーン下面に転がり接触する上部車輪と、固定面に転がり接触する下部車輪と、上部車輪の回転を下部車輪に伝達する伝動機構とを備えた構成としたものである。

【0017】また、前記構成において、チェーンの屈曲部と移動端との間に複数の移動支持体が配備されるとともに、移動端寄りの移動支持体ほど移動時の下部車輪の周速が速くなるように伝動機構の伝達比率が設定された構成としたものである。

【0018】

【発明の実施の形態】以下、本発明に係る可撓性長尺物の保護装置を図面に基づいて説明する。図1～図3は、本発明の一実施形態を示しており、図1に符号1Aで全体的に示される可撓性長尺物の保護装置は、前記従来例における保護装置100の構成に加えて、チェーン4の屈曲部20の内側近傍に配された移動支持体30を備えている。なお、チェーン4、保持部材16、固定支持ローラ18、19等の移動支持体30以外の構成は前記保護装置100とほぼ同様であるので、同一の符号を付して説明を省略する。

【0019】移動支持体30は、図2及び図3に示すように、略直方体の箱状に形成されたフレーム31と、それぞれ左右一対ずつの上部車輪32、下部車輪33、及び下部車輪34とを備えている。各車輪32、33、34は、フレーム31にピロー形軸受35を介して回転自在に枢支された車軸32a、33a、34aの両端にそれぞれ固設されている。

【0020】上部車輪32の車軸32aにはスプロケット36が設けられ、下部車輪33の車軸33aにはスプロケット37が設けられ、スプロケット36とスプロケット37との間に環状の伝動チェーン38が掛け渡されている。上部車輪32と下部車輪33との直径は等しく、かつ、スプロケット36とスプロケット37との歯数も等しく設定され、上部車輪32が回転すると、下部車輪33も上部車輪32と等しい周速で回転するようになっている。

【0021】また、下部車輪33、34の下端から上部車輪32の上端までの高さは、チェーン4を所定の屈曲半径Rで自然に屈曲させた場合の、図13(b)に示したように屈曲部20上端が最も高くなった状態における、固定端6側のチェーン4上面から移動端5側のチェーン4下面までの高さよりも、僅かに高く設定されている。

【0022】この移動支持体30が、屈曲部20よりも移動端5側の直線部21におけるチェーン4下面に上部車輪32が接触するとともに、この上部車輪32が接触

するチェーン4下面と対向する屈曲部20よりも固定端6側のチェーン4上面(固定面の一例)に下部車輪33, 34が接触する状態に設けられているので、上部車輪32が接触する位置でのチェーン4下面は、前記図13(b)の状態からさらに図2に $h_2$ で示した高さだけ上方に持ち上げられた状態で支持されることになっている。また、これによって、屈曲部20におけるチェーン4は、自然状態での屈曲半径Rよりも僅かに大きい屈曲半径R'で屈曲することになっている。

【0023】なお、前記 $h_2$ の高さは限定されないが、実際上は例えば数ミリメートルから数センチメートルといった高さが好ましい。また、図1の符号K'は、上部車輪32が固定支持ローラ18に衝突するのを防ぐために設定された「余裕長さ」を示しており、図3の符号39は、チェーン4からの脱輪を防止するために各車輪32, 33, 34の両側に設けられたフランジを示している。

【0024】以上のように構成されているので、機械可動部3及び移動端5が移動すると移動支持体30は、上部車輪32が直線部21におけるチェーン4下面を転動するとともに、この上部車輪32の回転が下部車輪33に伝えられて、下部車輪33及び下部車輪34が屈曲部20と固定端6との間のチェーン4上面を転動する。そして、この際の上部車輪32と下部車輪33との周速が等しいために、移動支持体30は移動端5の移動速度の1/2の速度、すなわち屈曲部20の移動速度と等しい速度で、移動端5の移動方向と同じ方向に移動する。

【0025】したがって、図1に示すように、移動端5の位置にかかわらず移動支持体30は屈曲部20近傍の位置でチェーン4下面を持ち上げた状態に支持するため、屈曲部20が移動しても従来のようにその上端が上下動することなく、そのため直線部21が振動したり共振を起こしたりすることもない。よって、リンク7にかかる荷重が小さくなり、かつ、直線部21の重量は上部車輪32に受け止められて屈曲部20のリンク7にはかからないので、リンク7や角度規制ピン11といった構成部品の強度が従来よりも低くて済み、そのぶんチェーン4の軽量化及び低コスト化が図れる。

【0026】なお、上部車輪32よりも移動端5側の直線部21は、その自重のために僅かに下向きに撓み、極端に示すと図4のような状態となって、上部車輪32、下部車輪33とチェーン4との間にスリップがあると移動支持体30が次第に屈曲部20に近寄ってくる場合がある。このような場合には、図4のように屈曲部20の内側に当接する適宜な形状の当接部材40を移動支持体30のフレーム31に取り付けることにより、下部車輪34が屈曲部20に乗り上げるのを防止することができる。

【0027】また、図5に示すように、移動支持体30の各車輪が接触するリンク7の一方の側面にラック41

を形成するとともに、上部車輪32及び下部車輪33(不図示)の周面にラック41と噛み合うピニオン状の歯42を形成したり、上部車輪32及び下部車輪33の周面に滑り止め用のゴム(不図示)を巻き付けたりすることにより、上部車輪32及び下部車輪33とチェーン4との間のスリップを防止し、これにより移動支持体30を位置決めして、下部車輪34の屈曲部20への乗り上げを防止することも考えられる。さらに、チェーン4に所定間隔で配設されている保持部材16と噛み合う突起(不図示)を上部車輪32及び下部車輪33の周面に形成し、これにより移動支持体30を位置決めすることも考えられる。

【0028】また、以上では下部車輪33, 34の転がり接触する固定面がチェーン4上面である場合を示したが、本発明にいう固定面はチェーン4上面に限られず、例えば下部車輪33, 34が固定端6から屈曲部20までのチェーン4を跨ぐ状態で床面2(固定面)に転がり接触する実施形態や、固定端6から屈曲部20までのチェーン4の両側に並行に設けられた一対のレール(不図示)の上面(固定面)に転がり接触するような実施形態も考えられる。

【0029】さらに、以上では上部車輪32の回転を下部車輪33に伝達する伝動機構が伝動チェーン38及びスプロケット36, 37からなる場合を示したが、伝動機構はこれに限られず、例えばVベルトとプーリとからなるものでもよく、互いに噛み合う複数の歯車からなるものでもよい。

【0030】さらにまた、以上では移動支持体30が上部車輪32と下部車輪33, 34とを備えた場合を示したが、図6に示した可撓性長尺物の保護装置1Bのように、互いに対向するチェーン4の上面と下面とに転がり接触する直径の大きなローラからなる移動支持体43を設け、これによってチェーン4下面を所定高さに支持することも考えられる。

【0031】図7は、本発明に係る可撓性長尺物の保護装置1Cの概略構成を示している。この保護装置1Cでは、チェーン4の屈曲部20と移動端5との間に3台の移動支持体30A, 30B, 30Cが配備されている。また、チェーン4の固定端6から先には、チェーン4とほぼ同じ断面形状の2列のレール44が敷設され、チェーン4の上面を固定端6に向かって移動してきた移動支持体30A等が固定端6を乗り越えて、レール44の上面(固定面)をさらに移動できるように構成されている。

【0032】なお、移動支持体30A, 30B, 30Cは、伝動機構の伝達比率が相互に異なっていること以外は、前記実施形態における移動支持体30と同様に構成されている。すなわち、図8に示すように、上部車輪32側のスプロケット36の半径 $r_1$ と、下部車輪33側のスプロケット37の半径 $r_2$ との比率が、最も移動端

5寄りの移動支持体30Aでは $r_1 / r_2 = 5$ 、中間の移動支持体30Bでは $r_1 / r_2 = 2$ 、最も屈曲部20寄りの移動支持体30Cでは $r_1 / r_2 = 1$ に設定されている。また、上部車輪32の直径と下部車輪33の直径とは全ての移動支持体とも等しくなっている。したがって、上部車輪32が回転すると下部車輪33は、移動支持体30Aでは上部車輪32の5倍の周速で、移動支持体30Bでは上部車輪32の2倍の周速で、移動支持体30Cでは上部車輪32と等しい周速で、それぞれ回転する。

【0033】ここで、上部車輪32及び下部車輪33とチェーン4との間にスリップがなければ、移動端5の移動距離を $V_0$ 、上部車輪32のチェーン4下面に対する転動距離を $V_1$ 、下部車輪33のチェーン4上面に対する転動距離を $V_2$ とすると、いずれの移動支持体についても、 $V_0 = V_1 + V_2$ の式が成り立つ。

【0034】また、 $V_1$ と $V_2$ との比率は上部車輪32との下部車輪33との周速の比率に等しいので、移動支持体30Aでは $V_1 : V_2 = 1 : 5$ 、移動支持体30Bでは $V_1 : V_2 = 1 : 2$ 、移動支持体30Cでは $V_1 : V_2 = 1 : 1$ となる。

【0035】したがって、図7に実線で示すように移動端5が移動ストロークSの一端にあって、移動端5から移動支持体30Aの上部車輪32までの距離が $K'$ 、移動支持体30A、30B、30Cの各上部車輪32の間隔が $S$ である状態から、移動端5が移動ストロークSの他端に向かって移動してゆくと、移動支持体30A、30B、30Cはともに移動端5と同じ方向に移動しながら、各移動支持体相互の間隔は次第に広がってゆく。

【0036】そして、図7に一点鎖線で示すように移動端5が移動ストロークSの他端に到達した時（すなわち $S = V_0 = V_1 + V_2$ となった時）には、移動支持体30Aにおいては $V_1 = S/6$ 、 $V_2 = (5/6)S$ となって、移動支持体30Aは元の位置から移動端5の移動方向に $(5/6)S$ だけ離れた位置に到達することになる。また、これと同様に、移動支持体30Bは元の位置から $(2/3)S$ だけ離れた位置に到達し、移動支持体30Cは元の位置から $S/2$ だけ離れた位置に到達することになる。

【0037】図10に示した従来の保護装置100では、前記のようにチェーン4の最長支持スパンが $(S/4) + K$ となり、移動ストロークSが長くなるほど最長支持スパンも長くなるためにチェーン4の強度を高くせざるを得ず、反対にチェーン4の強度が一定であれば移動ストロークSを一定以上に延長することができなかった。また、図1に示した保護装置1Aでは、前記のように屈曲部20上端の上下動に起因する振動を抑えてチェーン4にかかる荷重を軽減できるものの、最長支持スパンは $(S/4) + K'$ で従来とほぼ同様であった。

【0038】これに対し、この実施形態の保護装置1C

では、前記保護装置1Aと同様に屈曲部20上端の上下動に起因する振動を抑えてチェーン4にかかる荷重を軽減できるのに加えて、チェーン4の支点間の支持スパンが最長でも $(S/6) + K'$ もしくは $(S/6) + L$ になって、保護装置1Aの場合の約2/3に短縮できるのでチェーン4の構成部品の強度がさらに低くて済み、チェーン4のより一層の軽量化及び低コスト化が図れる。また、同じ強度のチェーン4を使用し、最長支持スパンも同じにするという条件では、移動端5の移動ストロークSを保護装置1Aの場合の約1.5倍に延長できる。

【0039】さらに、図14に示したように、固定支持ローラ18、19を備えた従来の保護装置100ではその全体を機械可動部3の移動領域3A外に設置せざるを得なかったが、この実施形態の保護装置1Cでは固定支持ローラが無いために、図9に示すように保護装置1Cの全体を機械可動部3の移動領域3A内に設置することができ、専用の設置スペースを必要としないので、省スペース化が図れる。

【0040】なお、この実施形態では3台の移動支持体を配備したが、移動ストロークSの長さ及び許容される最長支持スパンの長さに応じて、移動支持体を2台もしくは4台以上配備してもよく、この場合、移動支持体の数を多くするほど最長支持スパンを短縮できることは勿論のことである。また、伝動機構の伝達比率もこの実施形態での設定に限定されず任意である。

【0041】さらに、この実施形態では各移動支持体のスプロケット36、37の半径の比率を異ならせ、上部車輪32と下部車輪33との直径の比率は同一としたが、本発明にいう伝動機構は、例えば上部車輪側のスプロケットと下部車輪側のスプロケットとの半径（歯数）の比率は一定とし、上部車輪と下部車輪との直径の比率に差を設けることにより、複数の移動支持体間で移動時の下部車輪の周速に差が生じるように構成されていてもよい。

【0042】

【発明の効果】以上説明したように、本発明に係る可撓性長尺物の保護装置によれば、移動支持体がチェーンの屈曲部と移動端との間でチェーン下面を所定高さに支持しながら移動端の移動方向に移動するので、屈曲部上端の上下動に起因するチェーンの振動を抑えることができ、チェーンの構成部品にかかる荷重を軽減でき、チェーンの軽量化及び低コスト化を図ることが可能となる。

【0043】また、チェーンの屈曲部と移動端との間に複数の移動支持体が配備されるとともに、移動端寄りの移動支持体ほど移動時の下部車輪の周速が速くなるように伝動機構の伝達比率が設定されたものでは、複数の移動支持体によって屈曲部から移動端までのチェーン下面を常にほぼ等しい比率の支持スパンで支持することができるので、チェーンの最長支持スパンを短縮してチェーンの構成部品にかかる荷重をさらに軽減することによ

り、チェーンのより一層の軽量化及び低コスト化を図ることが可能となり、また、最長支持スパンを同じにして移動端の移動ストロークを延長することも可能となり、しかも、従来設けられていた固定支持ローラを無くせるので、保護装置の全体を機械可動部等の移動領域内に設置できることになって、省スペース化が図れる。

【図面の簡単な説明】

【図1】本発明の一実施形態に係る可撓性長尺物の保護装置の概略側面図である。

【図2】図1の保護装置の要部拡大側面図である。

【図3】図2のA-A線拡大断面図である。

【図4】当接部材を備えた移動支持体の側面図である。

【図5】ラックを設けたリンクと上部車輪とを示す概略側面図である。

【図6】本発明の別の実施形態に係る可撓性長尺物の保護装置の要部側面図である。

【図7】本発明のさらに別の実施形態に係る可撓性長尺物の保護装置の概略構成図である。

【図8】図7の保護装置における移動支持体の側面図である。

【図9】図7の保護装置の概略平面図である。

【図10】従来例に係る可撓性長尺物の保護装置の概略側面図である。

【図11】チェーンのリンクと保持部材とを示す一部分解斜視図である。

【図12】チェーンの要部側面図である。

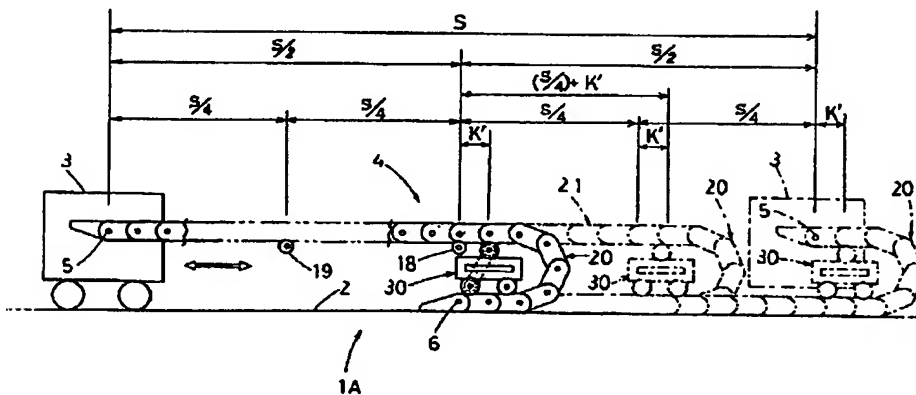
【図13】チェーンの上下動を説明する説明図である。

【図14】図10の保護装置の概略平面図である。

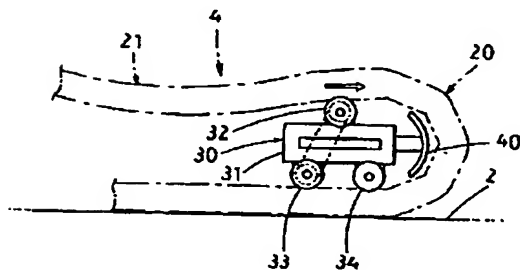
【符号の説明】

1A, 1B, 1C	保護装置
4	チェーン
5	移動端
6	固定端
20	屈曲部
30, 30A, 30B, 30C, 43	移動支持体
32	上部車輪
33	下部車輪
36, 37	スプロケット（伝動機構の一部）
38	伝動チェーン（伝動機構の一部）

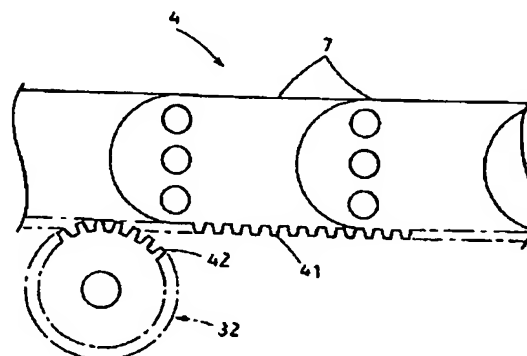
【図1】



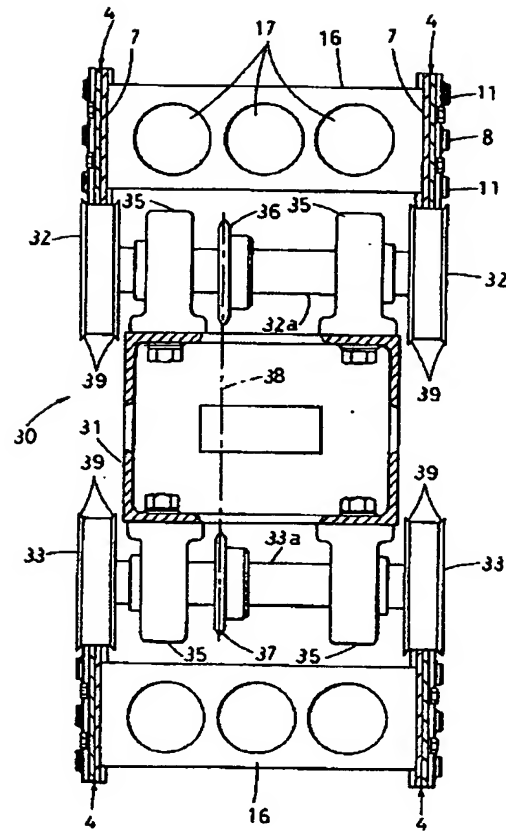
【図4】



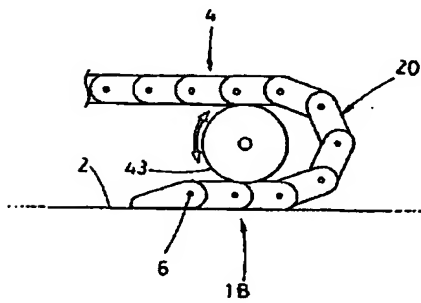
【図5】



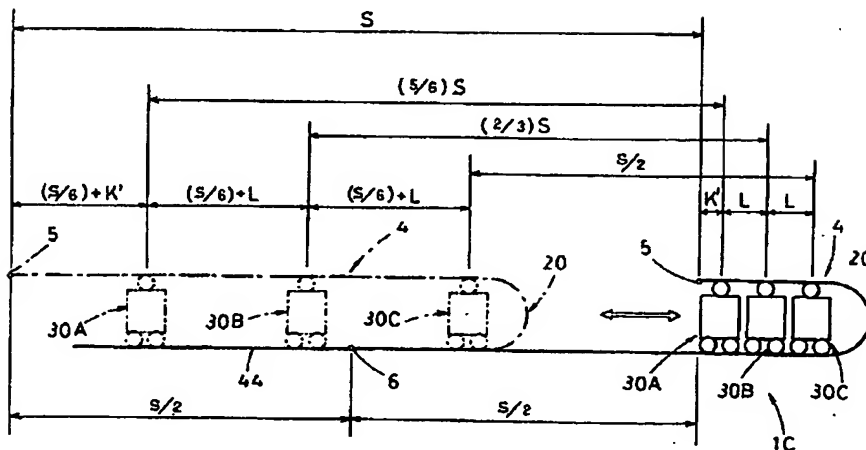
【図3】



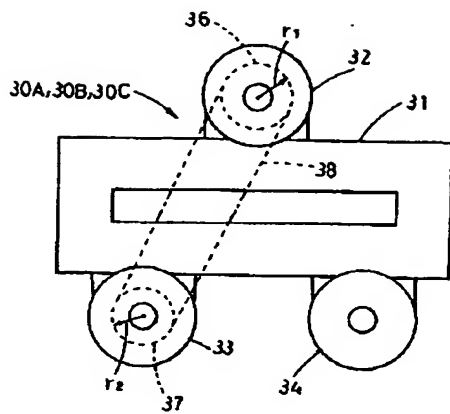
【图6】



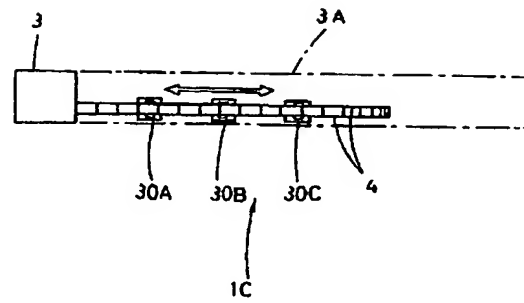
【図7】



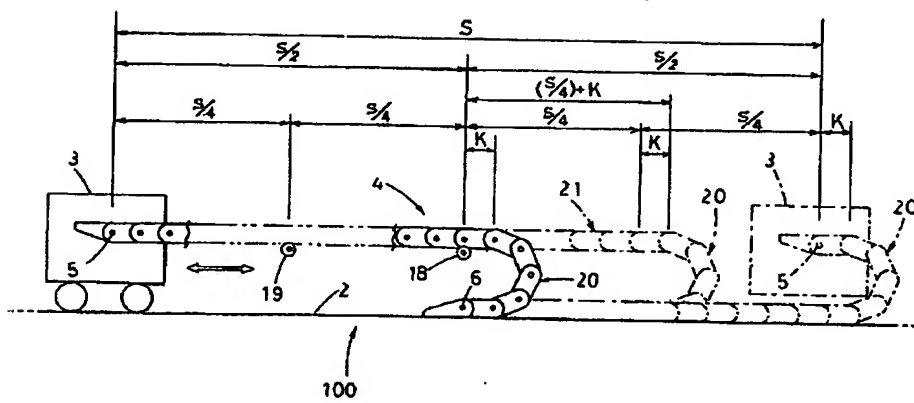
【図8】



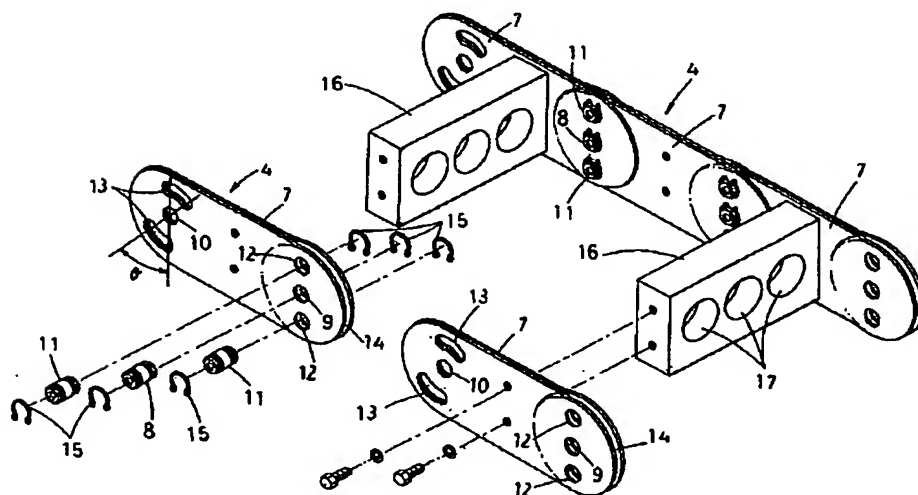
【図9】



【図10】

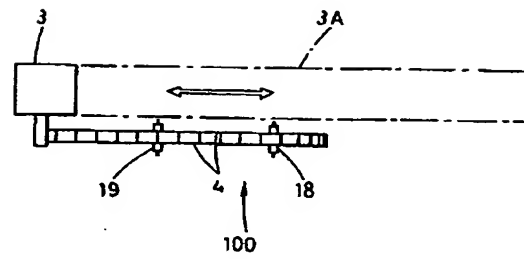


【図11】

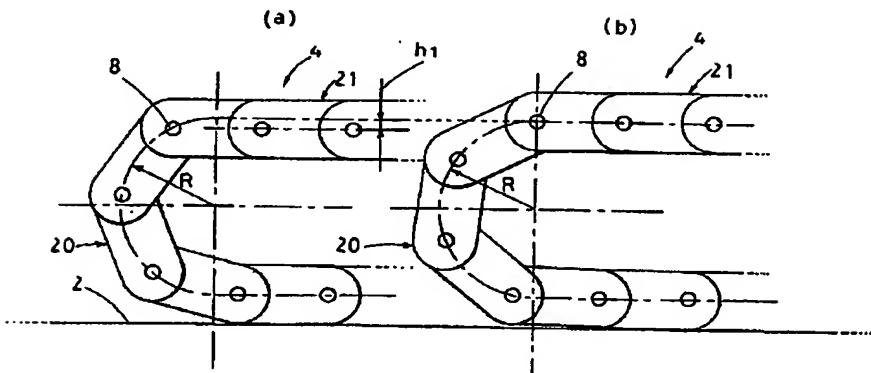




【図14】

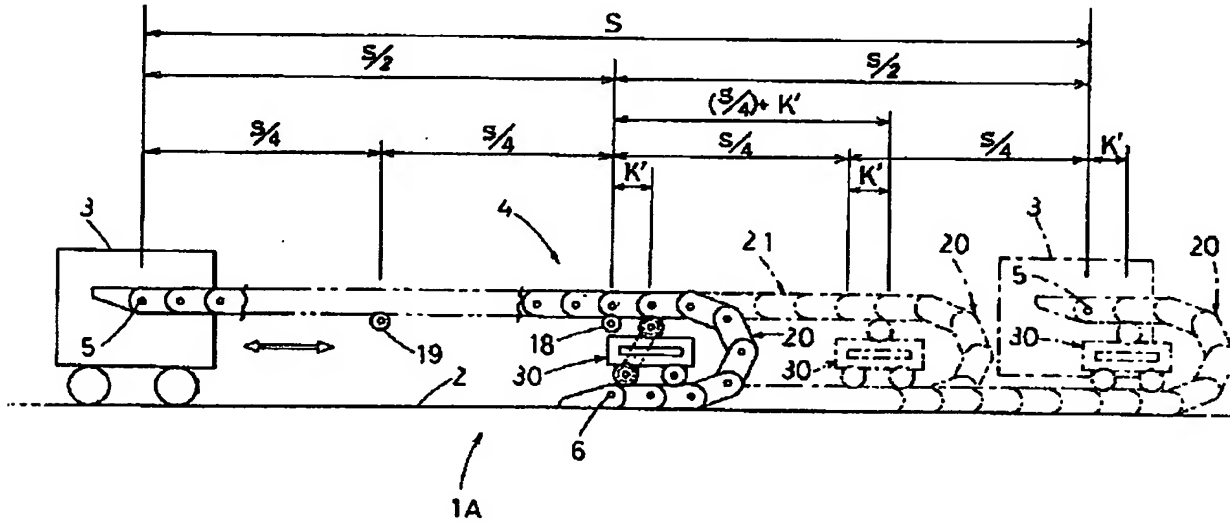


【例 13】

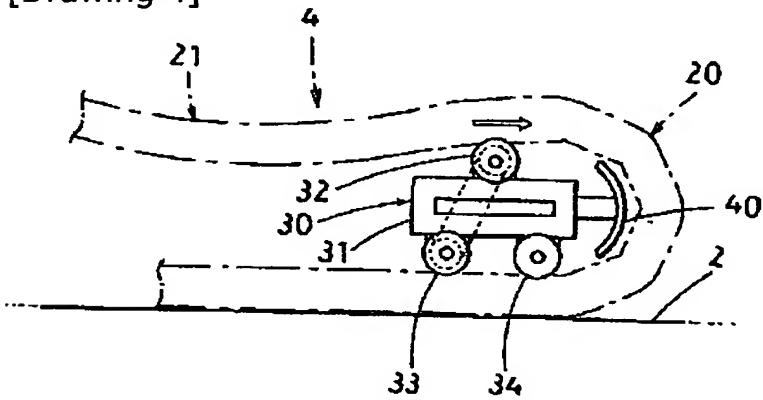


DRAWINGS

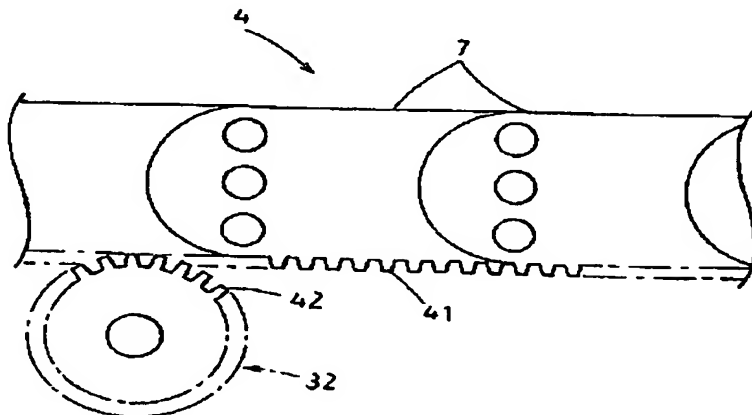
[Drawing 1]



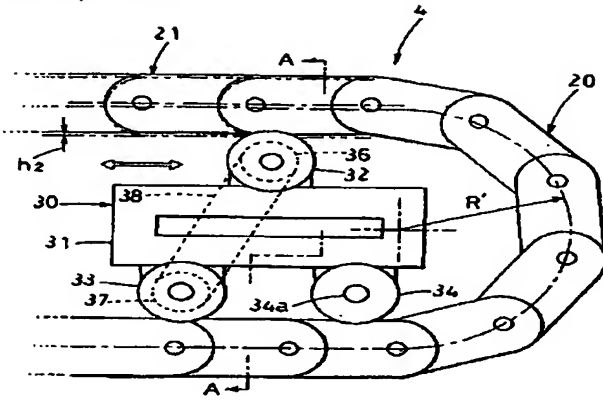
[Drawing 4]



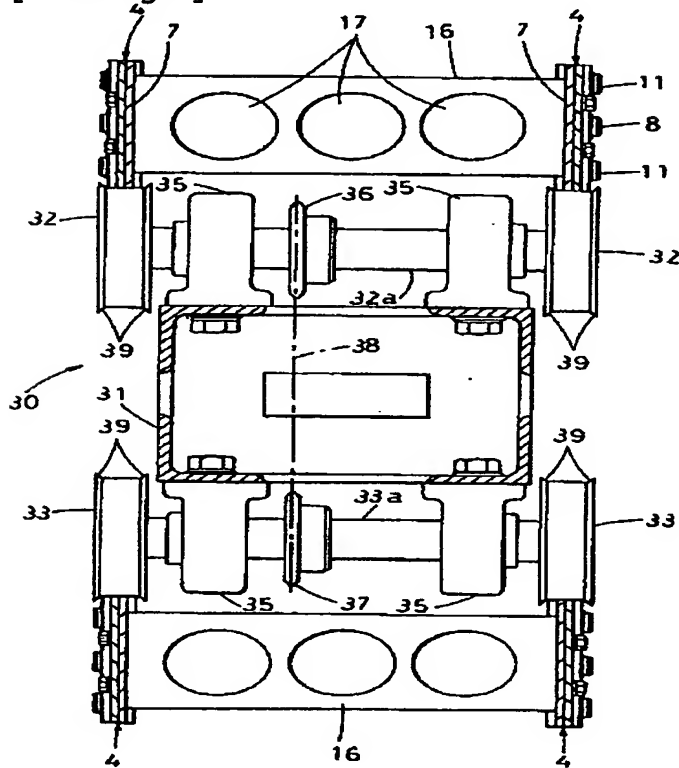
[Drawing 5]



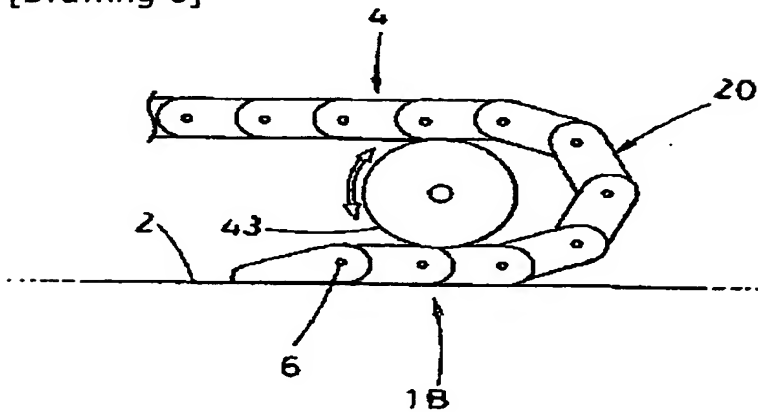
[Drawing 2]



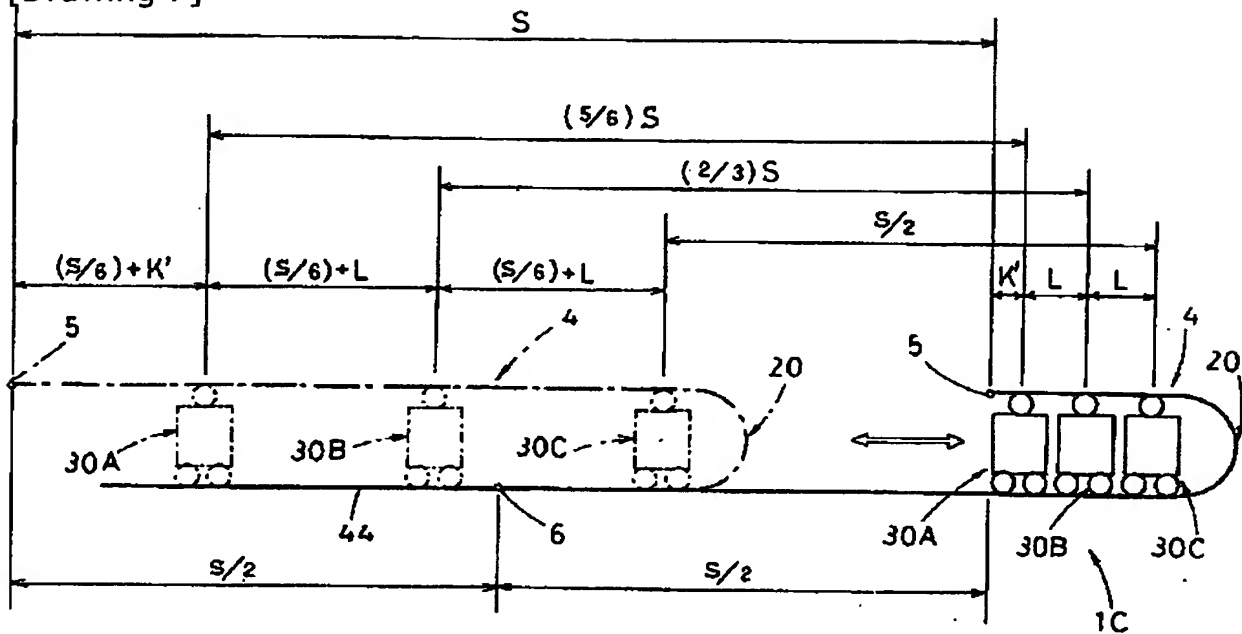
[Drawing 3]



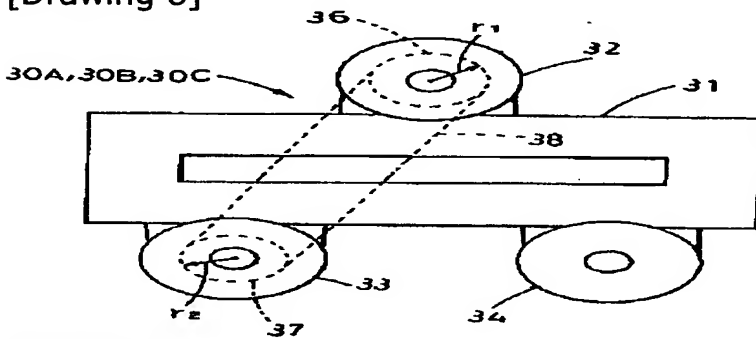
[Drawing 6]



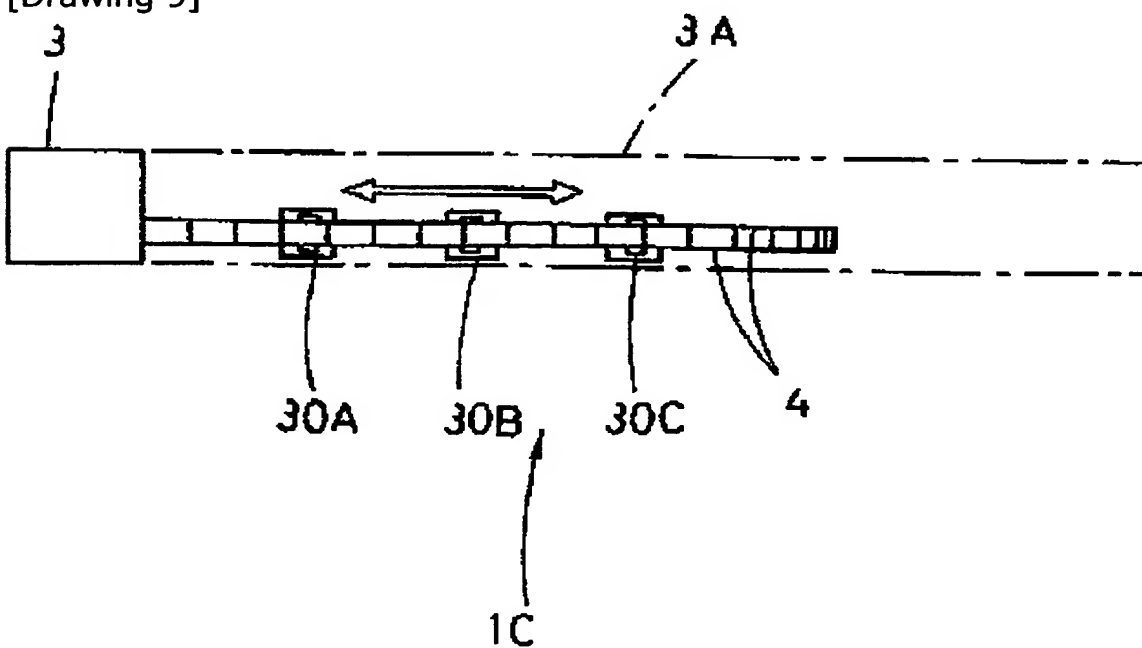
[Drawing 7]



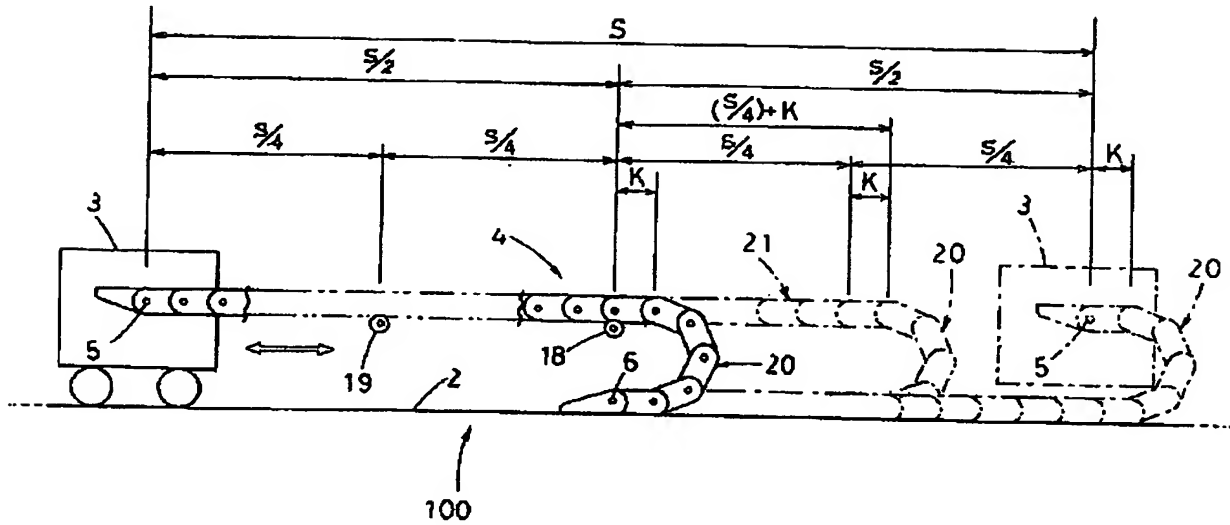
[Drawing 8]



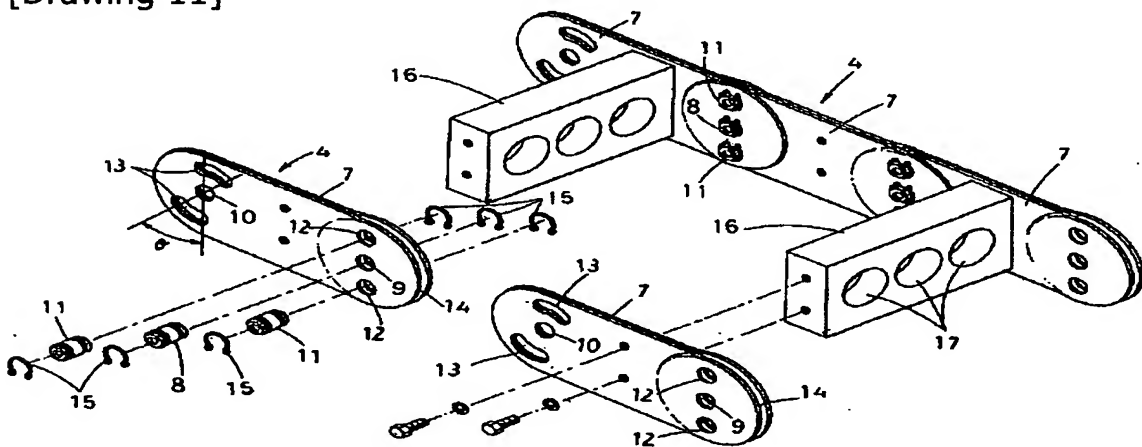
[Drawing 9]



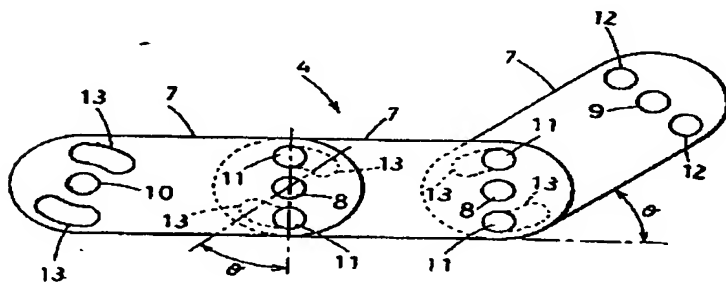
[Drawing 10]



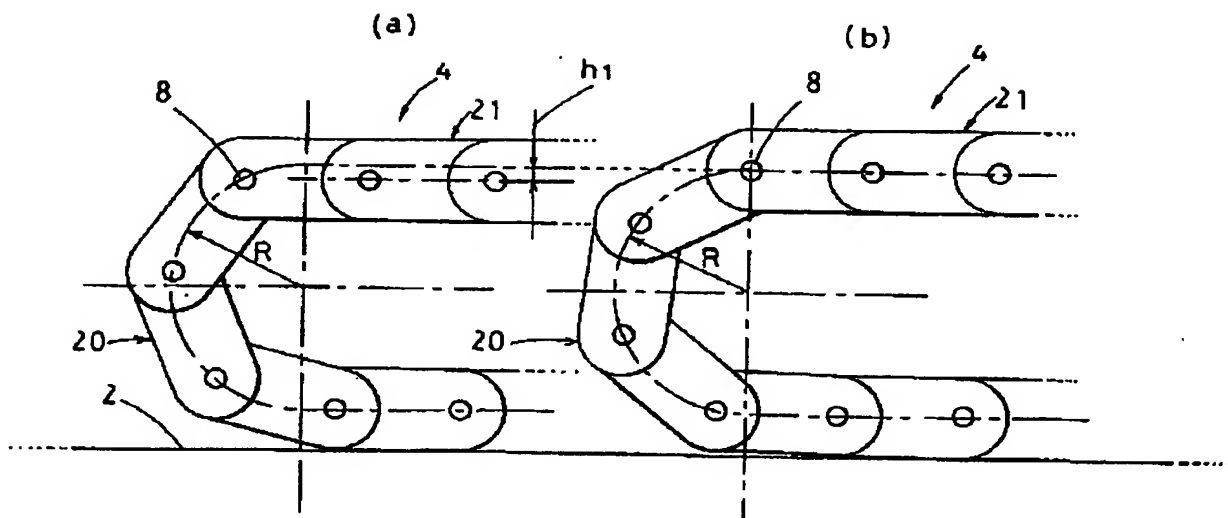
[Drawing 11]



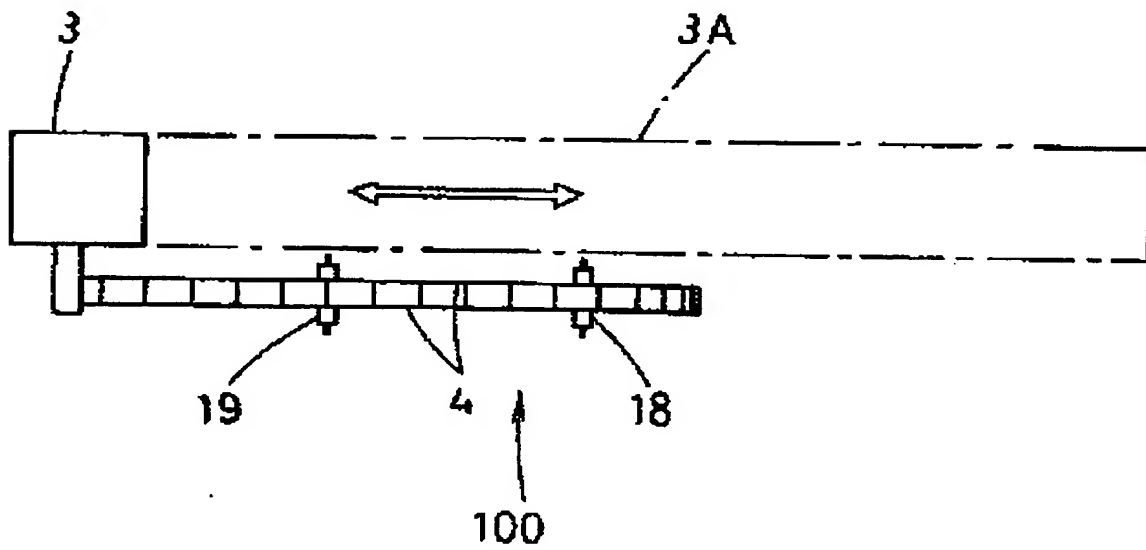
[Drawing 12]



[Drawing 13]



[Drawing 14]



**Claims**

[Claim 1] In that by which it is the protective device which regulates the incurvation radius of a flexible long picture object using a chain more than fixed, and the aforementioned chain is again bent by lengthwise between a move edge and the fixed end While supporting a chain inferior surface of tongue in predetermined height between the flections of a chain and move edges which are again bent by lengthwise The protective device of the flexible long picture object characterized by having the move base material which moves in the move direction of a move edge while carrying out the rolling contact to the aforementioned chain inferior surface of tongue and the fixed side which counters this with movement of a move edge.

[Claim 2] A move base material is the protective device of the flexible long picture object according to claim 1 which comes to have the up wheel which carries out the rolling contact to the chain inferior surface of tongue between a flection and a move edge, the lower wheel which carries out the rolling contact to a fixed side, and the driving mechanism which transmits rotation of an up wheel to a lower wheel.

[Claim 3] The protective device of the flexible long picture object according to claim 2 with which the rate of a transfer ratio of a driving mechanism is set up so that the peripheral speed of the lower wheel at the time of movement may become quick in the move base material of move edge approach while two or more move base materials are arranged between the flection of a chain, and a move edge.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the protective device of the flexible long picture object which regulates the incurvation radius of flexible long picture objects, such as a cable and a hose, using a chain more than fixed.

[0002]

[Description of the Prior Art] Neither a cable nor a hose may be unable to be damaged if bending below a fixed radius is given, or it may be able to stop being able to demonstrate an expected function. Then, when installing flexible long picture objects, such as a cable and a hose, between fixed parts, such as a machinery, and moving part, it is conventionally common to protect a flexible long picture object with the protective device using the chain with which below the permission incurvation radius of a flexible long picture object is not crooked (references, such as JP,55-53810,Y and JP,61-23959,Y).

[0003] This kind of protective device is like drawing 10 - drawing 12 .

That is, in drawing 10 , on the whole, the sign 100 shows the protective device of a flexible long picture object, an end (move edge 5) is fixed to the machine moving part 3, and 4 shows the chain of the protective device 100 with which the other end (fixed end 6) was fixed to the floor line 2 in the machine moving part to which, as for a sign 2, 3 carries out both-way movement of the floor-line 2 top for a floor line in the direction of an arrow, respectively.

[0004] As shown in drawing 11 , the holes 9 and 10 for inserting in the pivotable support pin 8, a pair each of holes 12 for inserting in the angle regulation pin 11, and the long hole 13 are formed in the link 7 of a large number which constitute a chain 4. The long hole 13 of a couple is the shape of radii of the angle theta centering on a hole 10. Moreover, the crevice 14 for inserting the other end of another link 7 is formed in the end side of a link 7. And the other end of another link 7 is inserted in the crevice 14 between one link 7, the pivotable support pin 8 and the angle regulation pin 11 are inserted in, respectively in the state where a hole 9, a hole 10 and a hole 12, and a long hole 13 lap, and each link 7 is mutually connected by inserting the snap ring 15 in the ends of each pin.

[0005] Therefore, although it can be crooked only in \*\* on the other hand in the radius as which a chain 4 is determined from the pitch (chain pitch) of the pivotable support pin 8, and an angle theta since only an angle theta can, on the other hand, rotate the link 7 which adjoins as shown in drawing 12 from an extension state only to \*\*, a straight-line state is maintained at an opposite direction. As shown in drawing 11 , while two trains of such chains 4 are arranged in parallel, it is mutually connected by the attachment component 16 infixed between the links 7 which counter. Two or more holes 17 for inserting in and holding flexible long picture objects, such as a cable and a hose, are formed in the attachment component 16.



[0006] Moreover, as shown in drawing 10 , the fixed support rollers 18 and 19 are formed in the protective device 100. The fixed support roller 18 is arranged in the center (namely, upper part of the fixed end 6) of the move stroke S of the move edge 5, and another side and the fixed support roller 19 are arranged in the middle of the fixed support roller 18 and the edge of the move stroke S. These fixed support rollers 18 and 19 are supported pivotably free [ rotation on the stand (un-illustrating) fixed to the floor line 2, respectively ].

[0007] Moreover, while the chain 4 of two trains connected by the attachment component 16 is again bent by lengthwise between the move edge 5 and the fixed end 6, the undersurface between this flection 20 and move edge 5 that are bent again is supported by the fixed support rollers 18 and 19. In addition, the sign K of drawing 10 shows the "margin length" set up in order to prevent that the flection 20 of a chain 4 runs aground on the fixed support roller 18.

[0008]

[Problem(s) to be Solved by the Invention] However, there were the following problems in the aforementioned conventional protective device 100. Namely, although the crookedness radius R of the chain 4 in a flection 20 is always fixed as shown in drawing 13 In case the link 7 of a chain 4 revolves one by one with movement of the machine moving part 3 and the move edge 5 and a flection 20 moves, in order that a chain 4 may carry out movement which a polygon rolls The position of flection 20 upper limit (pivotable support pin 8) becomes low like drawing 13 (a), or it becomes high like drawing 13 (b), and is h1. Vertical movement of the shown range arose.

[0009] The bay 21 (refer to drawing 10 ) of the chain 4 supported between the supporting points (there are a case of the fixed support roller 18 and a case of the move edge 5 with the position of the move edge 5) which adjoin flection 20 upper limit and this for this vertical movement was vibrated compulsorily. When the resonant frequency of the bay 21 which changes according to the distance (support span) to the supporting point which adjoins from flection 20 upper limit especially is in agreement with the vibration frequency of the aforementioned vertical movement, intense resonance of the vertical direction will arise in a bay 21.

[0010] And in order for the load concerning the both ends and the angle regulation pin 11 of a long hole 13 of a link 7 to become large and for the weight of a bay 21 especially to also join the link 7 of a flection 20 by vibration of the above chains 4, the intensity of a component part called the link 7 and the angle regulation pin 11 of a chain 4 in the required shell and the former which enable it to bear such a load by a twice [ about ] as many load as a bay 21 becoming this thing -- high -- not carrying out -- it did not obtain but, for the reason, lightweight-izing and low-cost-izing of a chain 4 were difficult

[0011] Moreover, although it can be arbitrarily shortened if the support span of the chain 4 in left-hand side [ center / of the move stroke S ] extends a fixed support roller by drawing 10 Since a fixed support roller cannot be formed in a flection 20 side (right-hand side of drawing 10 )

rather than the center of the move stroke S, The support span between the supporting points which adjoin flection 20 upper limit and this (when the move edge 5 laps with the fixed support roller 18, it becomes the longest with  $(S/4)+K$ ) was not able to be shortened. Therefore, since the longest support span also became long so that the move stroke S became long, the move stroke S was inextensible more than fixed from the relation of the longest support span which does not obtain a high kink colander, but is permitted in the intensity of a chain 4 if the intensity of a chain 4 is fixed on the contrary.

[0012] Furthermore, in order to avoid the collision with the machine moving part 3, as shown in drawing 14, the fixed support rollers 18 and 19 had to be formed out of move field 3A of the machine moving part 3, for this reason, the whole protective device 100 must be installed out of move field 3A, and there was also a problem of requiring the installation space of exclusive use.

[0013] this invention is made in view of the above problems, can mitigate the load applied to the component part of a chain by suppressing vibration resulting from vertical movement of a flection upper limit, and aims at offer of the protective device of a flexible long picture object which can attain lightweight-izing and low-cost-izing of a chain.

[0014] Moreover, it aims at offer of the protective device of the aforementioned flexible long picture object [ it is possible to shorten the longest support span of a chain conventionally, and if the longest support span is the same, it is possible to extend the move stroke of a move edge conventionally, and ] which it can install in the move field of machine moving part, and can moreover also attain \*\* space-ization in eye.

[0015]

[Means for Solving the Problem] In that by which this invention is a protective device which regulates the crookedness radius of a flexible long picture object using a chain more than fixed, and the aforementioned chain is again bent by lengthwise between a move edge and the fixed end in order to attain the aforementioned purpose While supporting the chain undersurface in predetermined height between the flections of a chain and move edges which are again bent by lengthwise, it considers as the composition equipped with the move base material which moves in the move direction of a move edge, carrying out the rolling contact to the aforementioned chain undersurface and the fixed side which counters this with movement of a move edge.

[0016] Moreover, in the aforementioned composition, a move base material is taken as the composition equipped with the up wheel which carries out the rolling contact to the chain inferior surface of tongue between a flection and a move edge, the lower wheel which carries out the rolling contact to a fixed side, and the driving mechanism which transmits rotation of an up wheel to a lower wheel.

[0017] Moreover, in the aforementioned composition, while two or more move base materials are arranged between the flection of a chain, and a move edge, the move base material of move edge approach is considered as the composition to which the rate of a transfer ratio of a driving

mechanism was set so that the peripheral speed of the lower wheel at the time of movement might become quick.

[0018]

[Embodiments of the Invention] Hereafter, the protective device of the flexible long picture object concerning this invention is explained based on a drawing. Drawing 1 - drawing 3 show 1 operation gestalt of this invention, and, in addition to the composition of the protective device 100 in the aforementioned conventional example, the protective device of the flexible long picture object shown in drawing 1 on the whole by sign 1A is equipped with the move base material 30 allotted near the inside of the flection 20 of a chain 4. In addition, since the composition of those other than move base material 30 of a chain 4, an attachment component 16, the fixed support roller 18, and 19 grades is the same as that of the aforementioned protective device 100 almost, the same sign is attached and explanation is omitted.

[0019] The move base material 30 is equipped with the up wheel 32, the lower wheel 33, and the lower wheel 34 of every a right-and-left couple with the frame 31 formed in box-like [ of an abbreviation rectangular parallelepiped ], respectively, as shown in drawing 2 and drawing 3 . Each wheels 32, 33, and 34 are fixed to the ends of the axles 32a, 33a, and 34a supported pivotably by the frame 31 free [ rotation ] through the pillow block 35, respectively.

[0020] A sprocket 36 is formed in axle 32a of the up wheel 32, a sprocket 37 is formed in axle 33a of the lower wheel 33, and it is built over the annular transmission chain 38 between the sprocket 36 and the sprocket 37. The diameter of the up wheel 32 and the lower wheel 33 will be rotated with peripheral speed also with the lower wheel 33 equal to the up wheel 32, if it is equal, and the number of teeth of a sprocket 36 and a sprocket 37 is also set up equally and the up wheel 32 rotates it.

[0021] Moreover, the height from the soffit of the lower wheels 33 and 34 to the upper limit of the up wheel 32 is slightly set up highly rather than the height from the chain 4 upper surface by the side of the fixed end 6 in the state where flection 20 upper limit became the highest to chain 4 inferior surface of tongue by the side of the move edge 5, as the chain 4 was shown in drawing 13 (b) at the time of making it automatically crooked in the predetermined incurvation radius R.

[0022] While the up wheel 32 contacts chain 4 inferior surface of tongue [ in / the bay 21 by the side of the move edge 5 / in this move base material 30 ] rather than a flection 20 Since it is prepared in the chain 4 upper surface by the side of the fixed end 6 (an example of a fixed side) at the state where the lower wheels 33 and 34 contact, rather than chain 4 inferior surface of tongue where the section wheel 32 besides contacts, and the flection 20 which counters Chain 4 inferior surface of tongue in the position where the up wheel 32 contacts is h2 from the state of aforementioned drawing 13 (b) to drawing 2 further. It is to be supported where only the shown height is raised up. Moreover, the chain 4 in a flection 20 is to be crooked by this by slightly larger incurvation radius R' than the incurvation radius R in a natural state.

[0023] In addition, the above h2 Although height is not limited, the height of several centimeters is desirable from several mm in practice, for example. Moreover, sign K' of drawing 1 shows the "margin length" set up in order to prevent the up wheel 32 colliding with the fixed support roller 18, and the sign 39 of drawing 3 shows the flange prepared in the both sides of each wheels 32, 33, and 34, in order to prevent derailment from a chain 4.

[0024] Since it is constituted as mentioned above, if the machine moving part 3 and the move edge 5 move, while the move base material 30 rolls chain 4 inferior surface of tongue [ in / a bay 21 / in the up wheel 32 ], rotation of this up wheel 32 will be told to the lower wheel 33, and the lower wheel 33 and the lower wheel 34 will roll the chain 4 upper surface between a flection 20 and the fixed end 6. And since the peripheral speed of the up wheel 32 in this case and the lower wheel 33 is equal, the move base materials 30 are one half of the speed of the traverse speed of the move edge 5, i.e., a speed equal to the traverse speed of a flection 20, and move in the same direction as the move direction of the move edge 5.

[0025] Therefore, even if a flection 20 moves in order to support the move base material 30 irrespective of the position of the move edge 5 in the state where the chain 4 undersurface was raised in the about 20-flection position as shown in drawing 1 , the upper limit does not move up and down like before, therefore a bay 21 does not vibrate or resonance is not caused. Therefore, since the load concerning a link 7 becomes small, and the weight of a bay 21 is caught by the up wheel 32 and the link 7 of a flection 20 is not started, the intensity of component parts, such as a link 7 and the angle regulation pin 11, is lower than before, it ends, and lightweight-izing and low-cost-izing of a chain 4 can be attained that much.

[0026] In addition, rather than the up wheel 32, the bay 21 by the side of the move edge 5 bends downward slightly because of the self-weight, if it is shown extremely, it will be in a state like drawing 4 , and if a slip is between the up wheel 32, the lower wheel 33, and a chain 4, the move base material 30 may approach a flection 20 gradually. in such a case, contact of the proper configuration which contacts inside a flection 20 like drawing 4 -- it can prevent that the lower wheel 34 runs aground to a flection 20 by attaching a member 40 in the frame 31 of the move base material 30

[0027] Moreover, as shown in drawing 5 , while forming a rack 41 in one side of a link 7 in which each wheel of the move base material 30 contacts By forming the gear tooth 42 of the shape of a pinion which gears with a rack 41 to the peripheral surface of the up wheel 32 and the lower wheel 33 (un-illustrating), or twisting the rubber for skids (un-illustrating) around the peripheral surface of the up wheel 32 and the lower wheel 33 Preventing the slip between the up wheel 32 and the lower wheel 33, and a chain 4, and this positioning the move base material 30 and preventing riding raising by the flection 20 of the lower wheel 34 is also considered. Furthermore, the salient (un-illustrating) which gears with the attachment component 16 currently arranged by the chain 4 at intervals of

predetermined is formed in the peripheral surface of the up wheel 32 and the lower wheel 33, and it is also considered that this positions the move base material 30.

[0028] Moreover, although the case where the fixed side the lower wheels 33 and 34 carry out [ a side ] the rolling contact was the chain 4 upper surface was shown above The operation form in which the fixed side said to this invention is not restricted to the chain 4 upper surface, for example, the lower wheels 33 and 34 carry out the rolling contact to a floor line 2 (fixed side) in the state over the chain 4 from the fixed end 6 to a flection 20, An operation form which carries out the rolling contact to the upper surface (fixed side) of the rail (un-illustrating) of a couple prepared in parallel with the both sides of the chain 4 from the fixed end 6 to a flection 20 is also considered.

[0029] Furthermore, although the case where the driving mechanism which transmits rotation of the up wheel 32 to the lower wheel 33 consisted of a transmission chain 38 and sprockets 36 and 37 was shown above, a driving mechanism may not be restricted to this, for example, may consist of a V belt and a pulley, and may consist of two or more gearings which mesh mutually.

[0030] The move base material 43 which consists of a roller with the big diameter which carries out the rolling contact is formed in the upper surface and the inferior surface of tongue of the chain 4 which counters mutually like [ although the case where the move base material 30 was equipped with the up wheel 32 and the lower wheels 33 and 34 was shown above further again ] protective device 1B of the flexible long picture object shown in drawing 6 , and supporting chain 4 inferior surface of tongue in predetermined height by this is also considered.

[0031] Drawing 7 shows the outline composition of protective device 1C of the flexible long picture object concerning this invention. In this protective device 1C, three sets of the move base materials 30A, 30B, and 30C are arranged between the flection 20 of a chain 4, and the move edge 5. Moreover, the rail 44 of two trains of the almost same cross-section configuration as a chain 4 is laid by the point from the fixed end 6 of a chain 4, and move base material 30A which has moved toward the fixed end 6 on the upper surface of a chain 4 overcomes the fixed end 6, and it is constituted so that it can move further on the upper surface (fixed side) of a rail 44.

[0032] In addition, the move base materials 30A, 30B, and 30C are constituted like the move base material 30 in the aforementioned operation gestalt except the rates of a transfer ratio of a driving mechanism differing mutually. that is, it is shown in drawing 8 -- as -- radius  $r_1$  of the sprocket 36 by the side of the up wheel 32 radius  $r_2$  of the sprocket 37 by the side of the lower wheel 33 a ratio -- most -- move base material 30A of move edge 5 approach --  $r_1/r_2 = 5$  and middle move base material 30B --  $r_1/r_2 = 2$  -- by move base material 30C of flection 20 approach, it is most set as  $r_1/r_2 = 1$  Moreover, as for the diameter of the up wheel 32, and the diameter of the lower wheel 33, all move base materials are equal. Therefore, if the up wheel 32 rotates, by move base

material 30B, it will be 5 times the peripheral speed of the up wheel 32, and the lower wheel 33 is the peripheral speed of the double precision of the up wheel 32, by move base material 30C, it will be a peripheral speed equal to the up wheel 32, and will be rotated at move base material 30A, respectively.

[0033] Here, it is rolling distance [ as opposed to the chain 4 upper surface of V1 and the lower wheel 33 for rolling distance / as opposed to / if there is no slip between the up wheel 32 and the lower wheel 33, and a chain 4 / chain 4 inferior surface of tongue of V0 and the up wheel 32 for the travel of the move edge 5 ] V2 When it carries out, it is  $V0 = V1 + V2$  also about which move base material. A formula is realized.

[0034] Moreover, V1 V2 Since it is equal to the ratio of peripheral speed with the lower wheel 33 with the up wheel 32, a ratio is V1 at move base material 30A. : At  $V2 = 1:5$  and move base material 30B, it is V1. : At  $V2 = 1:2$  and move base material 30C, it is V1. : It is set to  $V2 = 1:1$ .

[0035] Therefore, as a solid line shows to drawing 7 , the move edge 5 is in the end of the move stroke S. From K' and the state where the interval of each up wheel 32 of the move base materials 30A, 30B, and 30C is L, if the move edge 5 moves toward the other end of the move stroke S, the distance from the move edge 5 to the up wheel 32 of move base material 30A While the move base materials 30A, 30B, and 30C move in the same direction as both the move edges 5, the interval between each move base material spreads gradually.

[0036] and as an alternate long and short dash line shows to drawing 7 , when the move edge 5 reaches the other end of the move stroke S, (namely, when set to  $S = V0 = V1 + V2$ ) It is set to  $V1 = S/6$  and  $V2 = (5/6)S$  in move base material 30A, and move base material 30A will arrive at the position which separated only  $S(5/6)$  from the original position in the move direction of the move edge 5. Moreover, like this, move base material 30B will arrive at the position which separated only  $S$  from the original position ( $2/3$ ), and move base material 30C will arrive at the position which separated only  $S/2$  from the original position.

[0037] In the conventional protective device 100 shown in drawing 10 , since the longest support span also became long so that the longest support span of a chain 4 is set to  $(S/4) + K$  as mentioned above and the move stroke S becomes long, a high kink colander was not obtained for the intensity of a chain 4, but when the intensity of a chain 4 was fixed on the contrary, the move stroke S was inextensible more than fixed.

Moreover, although the load which suppresses vibration which originates in vertical movement of flection 20 upper limit as mentioned above in protective device 1A shown in drawing 1 , and is applied to a chain 4 was mitigable, the longest support span was the same as usual almost at  $(S/4) + K'$ .

[0038] on the other hand, in protective device 1C of this operation gestalt It adds, although the load which suppresses vibration which originates in vertical movement of flection 20 upper limit like the aforementioned protective device 1A, and is applied to a chain 4 is mitigable. the support span between the supporting points of a chain 4 -- the longest --  $(S/6) + K'$

or (S/6) +L -- becoming -- about [ in protective device 1A ] -- since it can be shortened to two thirds, the intensity of the component part of a chain 4 is still lower, and it ends, and much more lightweight-izing and low-cost-izing of a chain 4 can be attained Moreover, the chain 4 of the same intensity is used and the move stroke S of the move edge 5 can be extended by about 1.5 times in protective device 1A on the conditions of also making the longest support span the same.

[0039] Furthermore, although the whole had to be installed out of move field 3A of the machine moving part 3 in the conventional protective device 100 equipped with the fixed support rollers 18 and 19 as shown in drawing 14 In protective device 1C of this operation gestalt, since the whole protective device 1C can be installed in move field 3A of the machine moving part 3 as shown in drawing 9 and the installation space of exclusive use is not needed in order that there may be no fixed support roller, \*\* space-ization can be attained.

[0040] in addition, although three sets of move base materials were arranged with this operation gestalt, according to the length of the move stroke S, and the length of the longest support span permitted, four or more sets may be arranged, and it comes out of a move base material not to mention the ability to shorten [ two sets or ] the longest support span, so that the number of move base materials is made [ many ] in this case Moreover, the rate of a transfer ratio of a driving mechanism is not limited to a setup with this operation gestalt, either, but is arbitrary.

[0041] Furthermore, although [ this operation gestalt ] the ratio of the radius of the sprockets 36 and 37 of each move base material was changed and the ratio of the diameter of the up wheel 32 and the lower wheel 33 is the same The driving mechanism said to this invention for example, by supposing that the ratio of the radius (number of teeth) of the sprocket by the side of an up wheel and the sprocket by the side of a lower wheel is fixed, and preparing a difference in the ratio of the diameter of an up wheel and a lower wheel It may be constituted so that a difference may arise in the peripheral speed of the lower wheel at the time of movement among two or more move base materials.

[0042]

[Effect of the Invention] Since it moves in the move direction of a move edge according to the protective device of the flexible long picture object concerning this invention while a move base material supports a chain inferior surface of tongue in predetermined height between the flection of a chain, and a move edge as explained above, the load which can suppress vibration of the chain resulting from vertical movement of a flection upper limit, and is applied to the component part of a chain can be mitigated, and it becomes that it is possible to attain lightweight-izing and low-cost-izing of a chain.

[0043] Moreover, while two or more move base materials are arranged between the flection of a chain, and a move edge In that to which the rate of a transfer ratio of a driving mechanism was set so that the peripheral speed of the lower wheel at the time of movement might become quick, the move base material of move edge approach Since the chain inferior



surface of tongue from a flexion to a move edge can be supported by the support span of an always almost equal ratio by two or more move base materials By mitigating further the load which shortens the longest support span of a chain and is applied to the component part of a chain Become possible to attain much more lightweight-izing and low-cost-izing of a chain, and it also becomes possible to make the longest support span the same and to extend the move stroke of a move edge, and moreover, since the fixed support roller formed conventionally can be lost The whole protective device can be installed in move fields, such as machine moving part, and \*\* space-ization can be attained.

#### TECHNICAL FIELD

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[The technical field to which invention belongs] this invention relates to the protective device of the flexible long picture object which regulates the incurvation radius of flexible long picture objects, such as a cable and a hose, using a chain more than fixed.

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#### PRIOR ART

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[Description of the Prior Art] Neither a cable nor a hose may be unable to be damaged if bending below a fixed radius is given, or it may be able to stop being able to demonstrate an expected function. Then, when installing flexible long picture objects, such as a cable and a hose, between fixed parts, such as a machinery, and moving part, it is conventionally common to protect a flexible long picture object with the protective device using the chain with which below the permission incurvation radius of a flexible long picture object is not crooked (references, such as JP,55-53810,Y and JP,61-23959,Y).

[0003] This kind of protective device is like drawing 10 - drawing 12 . That is, in drawing 10 , on the whole, the sign 100 shows the protective device of a flexible long picture object, an end (move edge 5) is fixed to the machine moving part 3, and 4 shows the chain of the protective device 100 with which the other end (fixed end 6) was fixed to the floor line 2 in the machine moving part to which, as for a sign 2, 3 carries out both-way movement of the floor-line 2 top for a floor line in the direction of an arrow, respectively.

[0004] As shown in drawing 11 , the holes 9 and 10 for inserting in the pivotable support pin 8, a pair each of holes 12 for inserting in the angle regulation pin 11, and the long hole 13 are formed in the link 7 of a large number which constitute a chain 4. The long hole 13 of a couple is the shape of radii of the angle theta centering on a hole 10. Moreover, the crevice 14 for inserting the other end of another link 7 is formed in the end side of a link 7. And the other end of another link 7 is inserted in the crevice 14 between one link 7, the pivotable support pin 8 and the angle



regulation pin 11 are inserted in, respectively in the state where a hole 9, a hole 10 and a hole 12, and a long hole 13 lap, and each link 7 is mutually connected by inserting the snap ring 15 in the ends of each pin. [0005] Therefore, although it can be crooked only in \*\* on the other hand in the radius as which a chain 4 is determined from the pitch (chain pitch) of the pivotable support pin 8, and an angle theta since only an angle theta can, on the other hand, rotate the link 7 which adjoins as shown in drawing 12 from an extension state only to \*\*, a straight-line state is maintained at an opposite direction. As shown in drawing 11, while two trains of such chains 4 are arranged in parallel, it is mutually connected by the attachment component 16 infixed between the links 7 which counter. Two or more holes 17 for inserting in and holding flexible long picture objects, such as a cable and a hose, are formed in the attachment component 16.

[0006] Moreover, as shown in drawing 10, the fixed support rollers 18 and 19 are formed in the protective device 100. The fixed support roller 18 is arranged in the center (namely, upper part of the fixed end 6) of the move stroke S of the move edge 5, and another side and the fixed support roller 19 are arranged in the middle of the fixed support roller 18 and the edge of the move stroke S. These fixed support rollers 18 and 19 are supported pivotably free [ rotation on the stand (un-illustrating) fixed to the floor line 2, respectively ].

[0007] Moreover, while the chain 4 of two trains connected by the attachment component 16 is again bent by lengthwise between the move edge 5 and the fixed end 6, the inferior surface of tongue between this flection 20 and move edge 5 that are bent again is supported by the fixed support rollers 18 and 19. In addition, the sign K of drawing 10 shows the "margin length" set up in order to prevent that the flection 20 of a chain 4 runs aground on the fixed support roller 18.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Since it moves in the move direction of a move edge according to the protective device of the flexible long picture object concerning this invention while a move base material supports the chain undersurface in predetermined height between the flection of a chain, and a move edge, as explained above The load which can suppress vibration of the chain resulting from vertical movement of a flection upper limit, and is applied to the component part of a chain can be mitigated, and it becomes possible to attain lightweight-izing and low-cost-izing of a chain.

[0043] Moreover, it is while two or more move base materials are arranged between the flection of a chain, and a move edge. In that to which the rate of a transfer ratio of a driving mechanism was set so that the peripheral speed of the lower wheel at the time of movement might become quick, the move base material of move edge approach Since the chain undersurface from a flection to a move edge can be supported by

the support span of an always almost equal ratio by two or more move base materials By mitigating further the load which shortens the longest support span of a chain and is applied to the component part of a chain Become possible to attain much more lightweight-izing and low-cost-izing of a chain, and it also becomes possible to make the longest support span the same and to extend the move stroke of a move edge, and moreover, since the fixed support roller formed conventionally can be lost The whole protective device can be installed in move fields, such as machine moving part, and \*\* space-ization can be attained.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, there were the following problems in the aforementioned conventional protective device 100. Namely, although the incurvation radius  $R$  of the chain 4 in a flection 20 is always fixed as shown in drawing 13 In case the link 7 of a chain 4 revolves one by one with movement of the machine moving part 3 and the move edge 5 and a flection 20 moves, in order that a chain 4 may carry out movement which a polygon rolls The position of flection 20 upper limit (pivotable support pin 8) becomes low like drawing 13 (a), or it becomes high like drawing 13 (b), and is  $h_1$ . Vertical movement of the shown range arose.

[0009] The bay 21 (refer to drawing 10 ) of the chain 4 supported between the supporting points (there are a case of the fixed support roller 18 and a case of the move edge 5 with the position of the move edge 5) which adjoin flection 20 upper limit and this for this vertical movement was vibrated compulsorily. When the resonant frequency of the bay 21 which changes according to the distance (support span) to the supporting point which adjoins from flection 20 upper limit especially is in agreement with the vibration frequency of the aforementioned vertical movement, intense resonance of the vertical direction will arise in a bay 21.

[0010] And in order for the load concerning the both ends and the angle regulation pin 11 of a long hole 13 of a link 7 to become large and for the weight of a bay 21 especially to also join the link 7 of a flection 20 by vibration of the above chains 4, the intensity of a component part called the link 7 and the angle regulation pin 11 of a chain 4 in the required shell and the former which enable it to bear such a load by a twice [ about ] as many load as a bay 21 becoming this thing -- high -- not carrying out -- it did not obtain but, for the reason, lightweight-izing and low-cost-izing of a chain 4 were difficult

[0011] Moreover, although it can be arbitrarily shortened if the support span of the chain 4 in left-hand side [ center / of the move stroke  $S$  ] extends a fixed support roller by drawing 10 Since a fixed support roller cannot be formed in a flection 20 side (right-hand side of drawing 10 ) rather than the center of the move stroke  $S$ , The support span between the supporting points which adjoin flection 20 upper limit and this (when

the move edge 5 laps with the fixed support roller 18, it becomes the longest with  $(S/4)+K$  was not able to be shortened. Therefore, since the longest support span also became long so that the move stroke S became long, the move stroke S was inextensible more than fixed from the relation of the longest support span which does not obtain a high kink colander, but is permitted in the intensity of a chain 4 if the intensity of a chain 4 is fixed on the contrary.

[0012] Furthermore, in order to avoid the collision with the machine moving part 3, as shown in drawing 14, the fixed support rollers 18 and 19 had to be formed out of move field 3A of the machine moving part 3, for this reason, the whole protective device 100 must be installed out of move field 3A, and there was also a problem of requiring the installation space of exclusive use.

[0013] this invention is made in view of the above problems, can mitigate the load applied to the component part of a chain by suppressing vibration resulting from vertical movement of a flexion upper limit, and aims at offer of the protective device of a flexible long picture object which can attain lightweight-izing and low-cost-izing of a chain.

[0014] Moreover, it aims at offer of the protective device of the aforementioned flexible long picture object [ it is possible to shorten the longest support span of a chain conventionally, and if the longest support span is the same, it is possible to extend the move stroke of a move edge conventionally, and ] which it can install in the move field of machine moving part, and can moreover also attain \*\* space-ization in eye.

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## MEANS

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[Means for Solving the Problem] In that by which this invention is a protective device which regulates the incurvation radius of a flexible long picture object using a chain more than fixed, and the aforementioned chain is again bent by lengthwise between a move edge and the fixed end in order to attain the aforementioned purpose While supporting a chain inferior surface of tongue in predetermined height between the flexions of a chain and move edges which are again bent by lengthwise, it considers as the composition equipped with the move base material which moves in the move direction of a move edge, carrying out the rolling contact to the aforementioned chain inferior surface of tongue and the fixed side which counters this with movement of a move edge.

[0016] Moreover, in the aforementioned composition, a move base material is taken as the composition equipped with the up wheel which carries out the rolling contact to the chain inferior surface of tongue between a flexion and a move edge, the lower wheel which carries out the rolling contact to a fixed side, and the driving mechanism which transmits rotation of an up wheel to a lower wheel.

[0017] Moreover, in the aforementioned composition, while two or more move base materials are arranged between the flexion of a chain, and a move edge, the move base material of move edge approach is considered as the composition to which the rate of a transfer ratio of a driving

mechanism was set so that the peripheral speed of the lower wheel at the time of movement might become quick.

[0018]

[Embodiments of the Invention] Hereafter, the protective device of the flexible long picture object concerning this invention is explained based on a drawing. Drawing 1 - drawing 3 show 1 operation gestalt of this invention, and, in addition to the composition of the protective device 100 in the aforementioned conventional example, the protective device of the flexible long picture object shown in drawing 1 on the whole by sign 1A is equipped with the move base material 30 allotted near the inside of the flection 20 of a chain 4. In addition, since the composition of those other than move base material 30 of a chain 4, an attachment component 16, the fixed support roller 18, and 19 grades is the same as that of the aforementioned protective device 100 almost, the same sign is attached and explanation is omitted.

[0019] The move base material 30 is equipped with the up wheel 32, the lower wheel 33, and the lower wheel 34 of every a right-and-left couple with the frame 31 formed in box-like [ of an abbreviation rectangular parallelepiped ], respectively, as shown in drawing 2 and drawing 3 . Each wheels 32, 33, and 34 are fixed to the ends of the axles 32a, 33a, and 34a supported pivotably by the frame 31 free [ rotation ] through the pillow block 35, respectively.

[0020] A sprocket 36 is formed in axle 32a of the up wheel 32, a sprocket 37 is formed in axle 33a of the lower wheel 33, and it is built over the annular transmission chain 38 between the sprocket 36 and the sprocket 37. The diameter of the up wheel 32 and the lower wheel 33 will be rotated with peripheral speed also with the lower wheel 33 equal to the up wheel 32, if it is equal, and the number of teeth of a sprocket 36 and a sprocket 37 is also set up equally and the up wheel 32 rotates it.

[0021] Moreover, the height from the soffit of the lower wheels 33 and 34 to the upper limit of the up wheel 32 is slightly set up highly rather than the height from the chain 4 upper surface by the side of the fixed end 6 in the state where flection 20 upper limit became the highest to chain 4 inferior surface of tongue by the side of the move edge 5, as the chain 4 was shown in drawing 13 (b) at the time of making it automatically crooked in the predetermined incurvation radius R.

[0022] While the up wheel 32 contacts chain 4 inferior surface of tongue [ in / the bay 21 by the side of the move edge 5 / in this move base material 30 ] rather than a flection 20 Since it is prepared in the chain 4 upper surface by the side of the fixed end 6 (an example of a fixed side) at the state where the lower wheels 33 and 34 contact, rather than chain 4 inferior surface of tongue where the section wheel 32 besides contacts, and the flection 20 which counters Chain 4 inferior surface of tongue in the position where the up wheel 32 contacts is h2 from the state of aforementioned drawing 13 (b) to drawing 2 further. It is to be supported where only the shown height is raised up. Moreover, the chain 4 in a flection 20 is to be crooked by this by slightly larger incurvation radius R' than the incurvation radius R in a natural state.

[0023] In addition, the above h2 Although height is not limited, the height of several centimeters is desirable from several mm in practice, for example. Moreover, sign K' of drawing 1 shows the "margin length" set up in order to prevent the up wheel 32 colliding with the fixed support roller 18, and the sign 39 of drawing 3 shows the flange prepared in the both sides of each wheels 32, 33, and 34, in order to prevent derailment from a chain 4.

[0024] Since it is constituted as mentioned above, if the machine moving part 3 and the move edge 5 move, while the move base material 30 rolls chain 4 inferior surface of tongue [ in / a bay 21 / in the up wheel 32 ], rotation of this up wheel 32 will be told to the lower wheel 33, and the lower wheel 33 and the lower wheel 34 will roll the chain 4 upper surface between a flection 20 and the fixed end 6. And since the peripheral speed of the up wheel 32 in this case and the lower wheel 33 is equal, the move base materials 30 are one half of the speed of the traverse speed of the move edge 5, i.e., a speed equal to the traverse speed of a flection 20, and move in the same direction as the move direction of the move edge 5.

[0025] Therefore, even if a flection 20 moves in order to support the move base material 30 irrespective of the position of the move edge 5 in the state where chain 4 inferior surface of tongue was raised in the about 20-flection position as shown in drawing 1 , the upper limit does not move up and down like before, therefore a bay 21 does not vibrate or resonance is not caused. Therefore, since the load concerning a link 7 becomes small, and the weight of a bay 21 is caught by the up wheel 32 and the link 7 of a flection 20 is not started, the intensity of component parts, such as a link 7 and the angle regulation pin 11, is lower than before, it ends, and lightweight-izing and low-cost-izing of a chain 4 can be attained that much.

[0026] In addition, rather than the up wheel 32, the bay 21 by the side of the move edge 5 bends downward slightly because of the self-weight, if it is shown extremely, it will be in a state like drawing 4 , and if a slip is between the up wheel 32, the lower wheel 33, and a chain 4, the move base material 30 may approach a flection 20 gradually. in such a case, contact of the proper configuration which contacts inside a flection 20 like drawing 4 -- it can prevent that the lower wheel 34 runs aground to a flection 20 by attaching a member 40 in the frame 31 of the move base material 30

[0027] Moreover, as shown in drawing 5 , while forming a rack 41 in one side of a link 7 in which each wheel of the move base material 30 contacts By forming the gear tooth 42 of the shape of a pinion which gears with a rack 41 to the peripheral surface of the up wheel 32 and the lower wheel 33 (un-illustrating), or twisting the rubber for skids (un-illustrating) around the peripheral surface of the up wheel 32 and the lower wheel 33 Preventing the slip between the up wheel 32 and the lower wheel 33, and a chain 4, and this positioning the move base material 30 and preventing riding raising by the flection 20 of the lower wheel 34 is also considered. Furthermore, the salient (un-illustrating) which gears with the attachment component 16 currently arranged by the chain 4 at intervals of

predetermined is formed in the peripheral surface of the up wheel 32 and the lower wheel 33, and it is also considered that this positions the move base material 30.

[0028] Moreover, although the case where the fixed side the lower wheels 33 and 34 carry out [ a side ] the rolling contact was the chain 4 upper surface was shown above The operation gestalt in which the fixed side said to this invention is not restricted to the chain 4 upper surface, for example, the lower wheels 33 and 34 carry out the rolling contact to a floor line 2 (fixed side) in the state over the chain 4 from the fixed end 6 to a flection 20, An operation gestalt which carries out the rolling contact to the upper surface (fixed side) of the rail (un-illustrating) of a couple prepared in parallel with the both sides of the chain 4 from the fixed end 6 to a flection 20 is also considered.

[0029] Furthermore, although the case where the driving mechanism which transmits rotation of the up wheel 32 to the lower wheel 33 consisted of a transmission chain 38 and sprockets 36 and 37 was shown above, a driving mechanism may not be restricted to this, for example, may consist of a V belt and a pulley, and may consist of two or more gearings which mesh mutually.

[0030] The move base material 43 which consists of a roller with the big diameter which carries out the rolling contact is formed in the upper surface and the inferior surface of tongue of the chain 4 which counters mutually like [ although the case where the move base material 30 was equipped with the up wheel 32 and the lower wheels 33 and 34 was shown above further again ] protective device 1B of the flexible long picture object shown in drawing 6 , and supporting chain 4 inferior surface of tongue in predetermined height by this is also considered.

[0031] Drawing 7 shows the outline composition of protective device 1C of the flexible long picture object concerning this invention. In this protective device 1C, three sets of the move base materials 30A, 30B, and 30C are arranged between the flection 20 of a chain 4, and the move edge 5. Moreover, the rail 44 of two trains of the almost same cross-section configuration as a chain 4 is laid by the point from the fixed end 6 of a chain 4, and move base material 30A which has moved toward the fixed end 6 on the upper surface of a chain 4 overcomes the fixed end 6, and it is constituted so that it can move further on the upper surface (fixed side) of a rail 44.

[0032] In addition, the move base materials 30A, 30B, and 30C are constituted like the move base material 30 in the aforementioned operation form except the rates of a transfer ratio of a driving mechanism differing mutually. that is, it is shown in drawing 8 -- as -- radius  $r_1$  of the sprocket 36 by the side of the up wheel 32 radius  $r_2$  of the sprocket 37 by the side of the lower wheel 33 a ratio -- most -- move base material 30A of move edge 5 approach --  $r_1/r_2 = 5$  and middle move base material 30B --  $r_1/r_2 = 2$  -- by move base material 30C of flection 20 approach, it is most set as  $r_1/r_2 = 1$  Moreover, as for the diameter of the up wheel 32, and the diameter of the lower wheel 33, all move base materials are equal. Therefore, if the up wheel 32 rotates, by move base material 30B,

it will be 5 times the peripheral speed of the up wheel 32, and the lower wheel 33 is the peripheral speed of the double precision of the up wheel 32, by move base material 30C, it will be a peripheral speed equal to the up wheel 32, and will be rotated at move base material 30A, respectively.

[0033] Here, it is rolling distance [ as opposed to the chain 4 upper surface of V1 and the lower wheel 33 for rolling distance / as opposed to / if there is no slip between the up wheel 32 and the lower wheel 33, and a chain 4 / chain 4 inferior surface of tongue of V0 and the up wheel 32 for the travel of the move edge 5 ] V2 When it carries out, it is  $V0 = V1 + V2$  also about which move base material. A formula is realized.

[0034] Moreover, V1 V2 Since it is equal to the ratio of peripheral speed with the lower wheel 33 with the up wheel 32, a ratio is V1 at move base material 30A. : At  $V2 = 1:5$  and move base material 30B, it is V1. : At  $V2 = 1:2$  and move base material 30C, it is V1. : It is set to  $V2 = 1:1$ .

[0035] Therefore, as a solid line shows to drawing 7 , the move edge 5 is in the end of the move stroke S. From K' and the state where the interval of each up wheel 32 of the move base materials 30A, 30B, and 30C is L, if the move edge 5 moves toward the other end of the move stroke S, the distance from the move edge 5 to the up wheel 32 of move base material 30A While the move base materials 30A, 30B, and 30C move in the same direction as both the move edges 5, the interval between each move base material spreads gradually.

[0036] and as an alternate long and short dash line shows to drawing 7 , when the move edge 5 reaches the other end of the move stroke S, (namely, when set to  $S = V0 = V1 + V2$ ) It is set to  $V1 = S/6$  and  $V2 = (5/6)S$  in move base material 30A, and move base material 30A will arrive at the position which separated only  $S(5/6)$  from the original position in the move direction of the move edge 5. Moreover, like this, move base material 30B will arrive at the position which separated only  $S$  from the original position ( $2/3$ ), and move base material 30C will arrive at the position which separated only  $S/2$  from the original position.

[0037] In the conventional protective device 100 shown in drawing 10 , since the longest support span also became long so that the longest support span of a chain 4 is set to  $(S/4) + K$  as mentioned above and the move stroke S becomes long, a high kink colander was not obtained for the intensity of a chain 4, but when the intensity of a chain 4 was fixed on the contrary, the move stroke S was inextensible more than fixed.

Moreover, although the load which suppresses vibration which originates in vertical movement of flection 20 upper limit as mentioned above in protective device 1A shown in drawing 1 , and is applied to a chain 4 was mitigable, the longest support span was the same as usual almost at  $(S/4) + K'$ .

[0038] on the other hand, in protective device 1C of this operation gestalt It adds, although the load which suppresses vibration which originates in vertical movement of flection 20 upper limit like the aforementioned protective device 1A, and is applied to a chain 4 is mitigable. the support span between the supporting points of a chain 4 -- the longest --  $(S/6) + K'$  or  $(S/6) + L$  -- becoming -- about [ in protective device 1A ] -- since it can



be shortened to two thirds, the intensity of the component part of a chain 4 is still lower, and it ends, and much more lightweight-izing and low-cost-izing of a chain 4 can be attained Moreover, the chain 4 of the same intensity is used and the move stroke S of the move edge 5 can be extended by about 1.5 times in protective device 1A on the conditions of also making the longest support span the same.

[0039] Furthermore, although the whole had to be installed out of move field 3A of the machine moving part 3 in the conventional protective device 100 equipped with the fixed support rollers 18 and 19 as shown in drawing 14 In protective device 1C of this operation gestalt, since the whole protective device 1C can be installed in move field 3A of the machine moving part 3 as shown in drawing 9 and the installation space of exclusive use is not needed in order that there may be no fixed support roller, \*\* space-ization can be attained.

[0040] in addition, although three sets of move base materials were arranged with this operation gestalt, according to the length of the move stroke S, and the length of the longest support span permitted, four or more sets may be arranged, and it comes out of a move base material not to mention the ability to shorten [ two sets or ] the longest support span, so that the number of move base materials is made [ many ] in this case Moreover, the rate of a transfer ratio of a driving mechanism is not limited to a setup with this operation gestalt, either, but is arbitrary.

[0041] Furthermore, although [ this operation gestalt ] the ratio of the radius of the sprockets 36 and 37 of each move base material was changed and the ratio of the diameter of the up wheel 32 and the lower wheel 33 is the same The driving mechanism said to this invention for example, by supposing that the ratio of the radius (number of teeth) of the sprocket by the side of an up wheel and the sprocket by the side of a lower wheel is fixed, and preparing a difference in the ratio of the diameter of an up wheel and a lower wheel It may be constituted so that a difference may arise in the peripheral speed of the lower wheel at the time of movement among two or more move base materials.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline side elevation of the protective device of the flexible long picture object concerning 1 operation gestalt of this invention.

[Drawing 2] It is the important section expansion side elevation of the protective device of drawing 1 .

[Drawing 3] It is the A-A line expanded sectional view of drawing 2 .

[Drawing 4] It is the side elevation of the move base material equipped with the contact member.

[Drawing 5] It is the outline side elevation showing the link in which the rack was prepared, and an up wheel.



[Drawing 6] It is the important section side elevation of the protective device of the flexible long picture object concerning another operation gestalt of this invention.

[Drawing 7] It is the outline block diagram of the protective device of the flexible long picture object concerning still more nearly another operation gestalt of this invention.

[Drawing 8] It is the side elevation of the move base material in the protective device of drawing 7 .

[Drawing 9] It is the outline plan of the protective device of drawing 7 .

[Drawing 10] It is the outline side elevation of the protective device of the flexible long picture object concerning the conventional example.

[Drawing 11] the link and attachment component of a chain are shown -- it is a solution perspective diagram in part

[Drawing 12] It is the important section side elevation of a chain.

[Drawing 13] It is explanatory drawing explaining vertical movement of a chain.

[Drawing 14] It is the outline plan of the protective device of drawing 10 .

[Description of Notations]

1A, 1B, 1C Protective device

4 Chain

5 Move Edge

6 Fixed End

20 Flection

30, 30A, 30B, 30C, 43 Move base material

32 Up Wheel

33 Lower Wheel

36 37 Sprocket (a part of driving mechanism)

38 Transmission Chain (a Part of Driving Mechanism)